REMARKS

Claims 5, 9, 17, 19, 21-23 and 32-34 are all the claims pending in the application. Claims 5, 9, 17, 19 and 21-23 are amended. Claims 32-34 are cancelled.

Claim Rejections - 35 USC § 103

Claims 5, 9, 17, 19, 21, 23, and 32, are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozawa (US 2002/0058186) in view of Kanda (US 2002/0086224). This rejection is traversed for at least the following reasons.

First, as to claim 32, the rejection is moot in view of the cancellation of the claim.

Second, as to the rejected claims, the Examiner repeats the basis for rejection of the identified claims, including the assertion that paragraphs 0050 and 0075 teach that the surface layer, which is a light translucent film, serves as an ammonium ion production prevention layer. The Examiner admits that Nozawa is silent about the oxidation of the surface of the wafer. Kanda at paragraph 0077 and Figs. 8 and 9 is cited for such teaching.

Amended Claim 5

Third, claim 5 has been amended to more specifically define the claimed halftone phase shift mask blank as comprising a light-semitransmissive film that is formed as one of (1) a single-layer structure or (2) multi-layer structure, where the single layer or the upper layer, respectively, has a metal, silicon and nitrogen. Further, the ammonium ion production preventing layer is formed by an oxidation of the surface of the one of the (1) a single-layer structure or (2) multi-layer structure, respectively. In other words, the same oxidation feature is applied to both single and multi-layer films. Finally, the ammonium ion production preventing layer has less nitrogen content relative to the light-semitransmissive film, other than a respective surface portion of the film. These changes define the structures that have been determined by the inventors to solve significant and unresolved problems in the art.

Specific Problems With Ammonium Were Identified by Inventor

The present inventor discovered that, if the light-semitransmissive film (light translucent film) contains nitrogen, ammonium ions are produced with the reaction between nitrogen contained in the film and H_2O in the atmosphere.

Specific Solutions Were Discovered by Inventor

Based on such discovery, the inventor decided (A) to form an ammonium ion production preventing layer using a surface portion of the light-semitransmissive film (light translucent film) in one of a single-layer structure or a multilayer structure containing nitrogen, and (B) to make the light-semitransmissive film contain oxygen in order to thereby reduce the content of nitrogen. As a result of these two effects, the production of the ammonium ions can be prevented.

Nozawa

The Examiner cites Nozawa for a teaching of the claimed subject matter but admits that Nozawa is silent about the oxidation of the surface of the wafer. However, Applicant respectfully submits that the basic assumption of the Examiner with regard to the scope of the teachings in Nozawa is in error.

Nozawa discloses a method of manufacturing a phase shift mask blank that has a light translucent film having a film characteristic superior in chemical resistance, internal stress, and the like by carrying out the thermal treatment of the light translucent film at more than 150°C after forming the light translucent film, comprising nitrogen, metal, and silicon as main component, on the transparent substrate (see ABSTRACT).

Nozawa Fails to Disclose Concern With Ammonium Ions and Low Nitrogen Content

Given the focus of Nozawa on chemical resistance and stress, Nozawa neither discloses nor suggests anything with regard to the following key points.

(a) Preventing the production of the ammonium ions.

(b) Forming the ammonium ion production preventing layer coupled with oxidation of the surface portion of the light-semitransmissive film in either of a single-layer structure or the upper layer of a multilayer structure, so as to contain metal, silicon, nitrogen and oxygen and have less nitrogen content relative to the light-semitransmissive film, other than the surface portion.

The Examiner's Cited Teaching is a Well Known Multi-Layer Structure

The Examiner bases the conclusions with regard to the relevance of Nozawa on the teachings in paragraph 0075 of the Nozawa publication where the publication describes the

alternatives of a multi-layer structure formed by laminating two or more layers of a low transmittance layer and a high transmittance layer. This structure is distinguished from light translucent films of single layer, where such single layer has no oxygen in a first aspect and such single layer has oxygen in a second aspect. As described in paragraph 0076, the high transmittance layer can optionally have nitrogen and oxygen, along with silicon or metal. The Examiner appears to assert that for the case where a high transmittance layer has no nitrogen while other layers have nitrogen, the claim limitations are met if the high transmittance layer is asserted to be an ammonium ion production preventing layer.

However, it is well known by those skilled in the art that a light-semitransmissive film in a phase shift mask blank can be a single-layer structure or a multilayer structure. Nozawa describes nothing more than this known prior art structure. Specifically, the light translucent film (light-semitransmissive film) of the multilayer structure described in paragraph 0075 merely indicates that the light translucent film can comprise a combination of a high transmittance layer and a low transmittance layer, which is an example in a general multilayer structure. There is no teaching, however, of the key feature of the invention, namely ***surface formation*** of an ammonium ion production preventing layer in the light semitransmissive film exposed surface.

Present Application Describes ***Same*** Surface Formation ***For Both*** Single and Multiple Layer Structures

The specification of the present invention (page 10) also describes (1) a case wherein the light-semitransmissive film is a single-layer structure and (2) a case wherein the light-semitransmissive film is a multilayer structure. The present invention involves forming the ammonium ion production preventing layer on the surface portion of the light-semitransmissive film in ***both*** the single-layer structure and in the multilayer structure.

Nozawa does not disclose or suggest the formation, ***on*** a surface portion of either a single layer or multi-layer structure, of a light semitransmissive film, as in the present invention.

Focus of Nozawa's Thermal Treatment is Different from Invention

Nozawa's thermal treatment is for reducing the film stress and the chemical resistance and the light resistance. It has nothing to do with the prevention of ammonium ion formation.

Specifically, the ***chemical resistance*** defined in Nozawa is a resistance to the washing liquid of the mask (see paragraph 0017). As would be understood by those skilled in the art, the ***light resistance*** defined in Nozawa is to a change in transmittance or the like caused by laser light while using the mask for a long period of time.

By contrast, the heat treatment (thermal treatment) in the present invention is for ***preventing production of the ammonium ions*** in order to reduce the ammonium sulfate etc which is deposited by laser irradiation. This feature is significantly different from the thermal treatment in Nozawa Patent.

Furthermore, although Nozawa's thermal treatment may not be a treatment that omits an atmosphere containing oxygen, it is a treatment for realizing reduction of the film stress and the like, as change is not given to film composition. This is supported by the descriptions that it is desirable not to include reactive atmosphere such as oxygen because the composition of direction of film thickness changes by including the reactive atmosphere (see paragraph 0035) and that it is prevented that the surface of the light translucent film is oxidized by introducing inert gas such as nitrogen (see paragraph 0108).

On the contrary, in the heat treatment of the present invention, oxygen is included in the surface of the light semi-transmissive film by positively oxidizing the surface of light semi-transmissive film and the film composition is changed in the direction of the film thickness so as to reduce the content of nitrogen. Such a heat treatment is quite different from the thermal treatment of Nozawa Patent.

Kanda

The Kanda publication also neither discloses nor suggests the above-mentioned key points that are basic to the present invention, namely:

(a) Preventing the production of the ammonium ions.

(b) Forming the ammonium ion production preventing layer coupled with oxidation of the surface portion of the light-semitransmissive film in a single-layer structure or the upper layer of a multilayer structure, so as to contain metal, silicon, nitrogen and oxygen and have less nitrogen content relative to the light-semitransmissive film, other than the surface portion.

Kanda Focuses Only On General Oxidation Processes

The Examiner cites paragraph 0077 of Kanda for at teaching relevant to the admitted omission in Nozawa. However, that text merely discloses a well known general oxidation process for a wafer when formed into a semiconductor device.

Specifically, the oxidized film formed with the step 11, as described in paragraph 0077 of Kanda, simply becomes the gate insulation film of an MOS transistor. Kanda has no teaching, or even motivation that would lead to an application of its oxidation process to the light-semitransmissive film of the phase shift mask in Nozawa.

Moreover, as mentioned above, since Nozawa teaches that the oxidation of the surface of the light translucent film ***is prevented*** by introducing an inert gas, such as nitrogen, and such prevention is in direct conflict with a process of oxidation, Nozawa provides no motivation to be combined with Kanda so that some oxidation process can be carried out.

For the reason mentioned above, the present invention claimed in amended independent claim 5 is patentable over Nozawa in view of Kanda.

The remaining claims that depend from claim 5 are also patentable for the foregoing reasons and because of their dependency from patentable claim 5.

Amended Claim 9

Claim 9 is directed to a halftone phase shift mask, and has been amended to define the light-semitransmissive film and the ammonium ion production preventing layer, as set forth in amended claim 5.

Claim 9 would be patentable for the same reasons given for claim 5. **Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nozawa (US 2002/0058186) and Kanda (US 2002/0086224) as applied to claims 5, 9, 17, 19, 21, 23, and 32 above, and in view of Ohshima (2002/0142249).** This rejection is traversed for at least the following reasons.

Oshima

The Examiner admits that Nozawa and Kanda fail to teach the claimed concentration of ammonium. The Examiner looks to Ohshima for a teaching of a concentration of ammonium ions that is from 0 to 10,000 ppm, which is less than 20 nanograms per centimeter squared (see

page 25, paragraph 0219). The Examiner concludes that this teaching supports a concentration of ammonium ions to be less than 20 nanograms per centimeter squared in Nozawa, "because Ohshima teaches the concentration of ammonium ions being less than 20 nanograms per centimeter to accommodate anodization treatment of a lithographic printing plate."

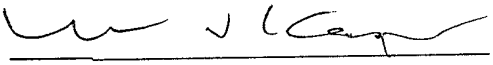
Applicants respectfully submit that Oshima is merely cited for a teaching of ammonium ion concentration levels, and does not remedy the fundamental deficiencies of Nozawa as to the limitations of parent claim 5.

Claims 33 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nozawa (US 2002/0058186) and Kanda (US 2002/0086224) as applied to claims 5, 9, 17, 19, 21, 23, and 32 above, and in view of Rolson (US 5,851,701). This rejection is moot in view of the cancellation of the rejected claims.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



Alan J. Kasper
Registration No. 25,426

SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE
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CUSTOMER NUMBER

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